The Committee Secretary
House of Representatives Standing Committee on Science and Innovation
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Inquiry into Coordination of the Science to Combat the Nation's Salinity Problem

INTRODUCTION

This Inquiry is critical in providing a process of public examination of the adequacy of public science to support the implementation of salinity management options for individuals, local government and industry.

This submission challenges the adequacy of the salinity science and the process by which public science is generated and used. For example, the results of the National Land and Resources Audit have produced salinity definitions and maps that are totally inadequate, and in most cases are fundamentally wrong and inappropriate for the purposes of land use management (see Map 11 in this submission).

This submission also proposes a new funding process that acknowledges the fundamental role of local government and industry in implementation of resource management, including the role of private companies (ie, knowledge companies) in salinity R&D, innovation and service delivery of resource management solutions. It is unfortunate that government programs separate environmental management (largely through catchment management boards or authorities) from the economic and social management capabilities of local government and industry, and this is a pathway to unsustainable communities.

This submission also outlines the value of the salinity science developed by Environmental Research and Information Consortium Pty Ltd-ERIC from 1992-2002. Natural Resource Intelligence Pty Ltd who patented the method in 2002 now owns the intellectual property for this method.

Context

As Managing Director of ERIC I was involved in salinity R&D, innovation and service delivery for over 10 years. During this period I provided salinity solutions primarily to local governments and corporations. This experience lead me to the conclusion that:

- The salinity science that is based primarily on a groundwater rising model is fundamentally flawed, unscientific and inappropriate in developing land use management options.
- Public institutions and agencies have dominated the salinity science to an extent that new salinity revelations and innovations in industry have been actively ignored and suppressed by public scientists and bureaucrats that have a vested interest in commanding and controlling public funds for salinity. Consequently, industry innovation (the transformation of ideas into commercial outcomes) is stifled.
- Publicly funded salinity programs have very poor linkages with the implementation capability of regional communities, ie. private companies and local governments. Commonwealth and state workers and catchment management committees (that are essentially operational arms of state bureaucracies) absorb high proportions of these public monies.
- Public salinity funds allocate an inappropriate proportion to administration, planning and research and inadequate amounts to implementation (eg. baseline data and knowledge, decision support arrangements, monitoring, and reporting to provide a feedback mechanism for program accountability and evaluation).
- The salinity programs have a negative focus on environmental and economic decline but there is little economic data to support such claims. For example, agricultural production and productivity in many saline areas (eg. the MIA) has increased. Also, environmental decline predicted from some saline areas has never eventuated. For example, the Jemalong/ Wyldes Plains area was predicted by CSIRO

scientists in 1993 to have significant salinity degradation increases by 2020, but in 2003 there is little or no sign of further degradation. During the past 15 years salinity has been promoted as the worst environmental problem facing Australia, but this message has been a monumental beat- up by public scientists with a vested interest in access to public funds for research.

- Salinity is not the most important issue faced by farmers who's production, productive and sustainability are largely influenced by appropriate enterprise site selection, climate, soil health (with salinity a minor component), disease control, access to water, and knowledge of land use and management practices. To this end a single and narrowly focussed salinity program is an inappropriate pathway to rural or agricultural sustainability. Salinity is a minor symptom of a much larger land use and soil health issue.

Outline of the Method

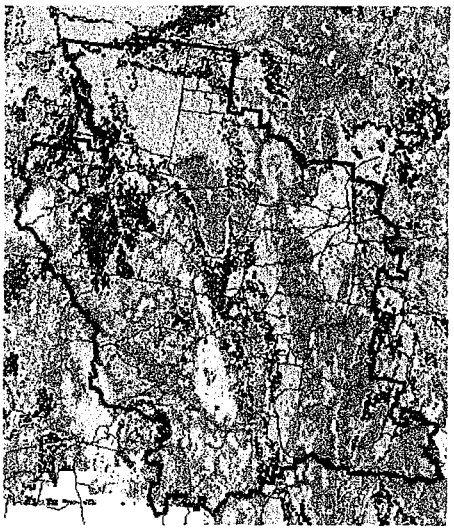
The following section is intended to highlight the inadequacies of current approaches to the generation and use of public science that excludes industry participation. Research undertaken by ERIC discovered that salinity (an increase in salt affected land above what would be expected from natural processes) was caused by soil degradation (primarily due to unsustainable land use practices rather than land clearing per se). This change in soil health decreases deep percolation of water and increases lateral flows of water through preferred pathways of geological fractures and old/ancient prior stream systems (eg. old Murrumbidgee and Murray River courses). ERIC developed a method to objectively map these saline pathways that could not be caused by groundwater rising processes. Although, lateral flows can concentrate and saturate areas with salt and water and this process is often perceived as groundwater rising in these areas.

ERIC explained this salinity science to CSIRO, BRS, NDSP and the NSW DLWC between 1992 and 1997. None of these organisations were prepared to collaborate with ERIC or examine ERIC's claim. However, if ERIC's claim is correct then the current programs of salinity research and implementation are based on wrong assumptions, models and actions to address salinity.

The method involves the numerical processing of 4 bands of gamma-ray data to classify the data into homogeneous patterns (based on spectral and spatial analysis). A map of about 30-40 classes is produced for field measurement and at least 5 samples (but often up to 10 samples are collected for each class or distinct pattern, see Map 1). The measurements include soil horizon depth and thickness, texture, pH, Eh, EC, etc. These sample measurements are stratified by the A1, A2, B1 and B2 soil horizons. This process enables soil property maps to be produced for each measured soil attribute (eg. Soil texture, see Map 2).

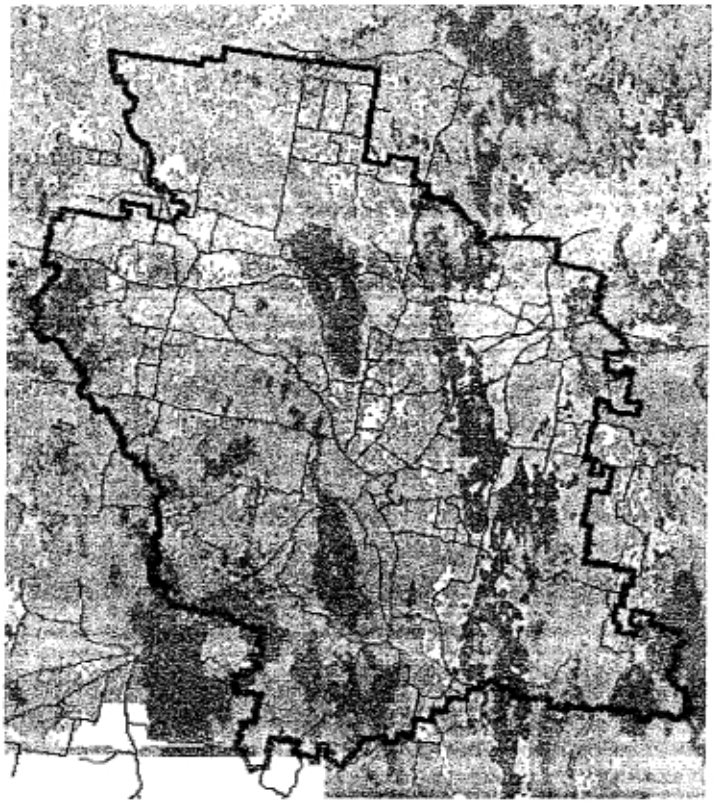
Map 1. Processed Gamma-ray Data

Map 2. Soil Property Map for Texture of the B2



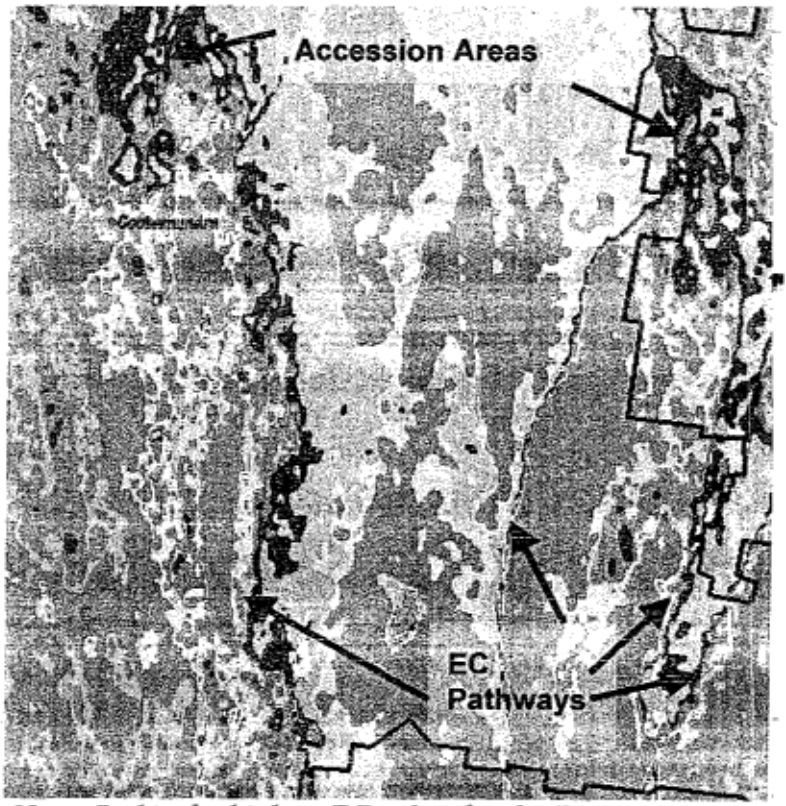
Similarly, soil property maps are produced for the distribution of EC for the A2 and B2 soil horizons (see Map 3). This enables the highest values of EC to be highlighted in relation landscape (eg. drainage or elevation) and cultural features (eg. infrastructure) (see Maps 4, 5 and 6)

Map 3. EC Distribution Map for B2.



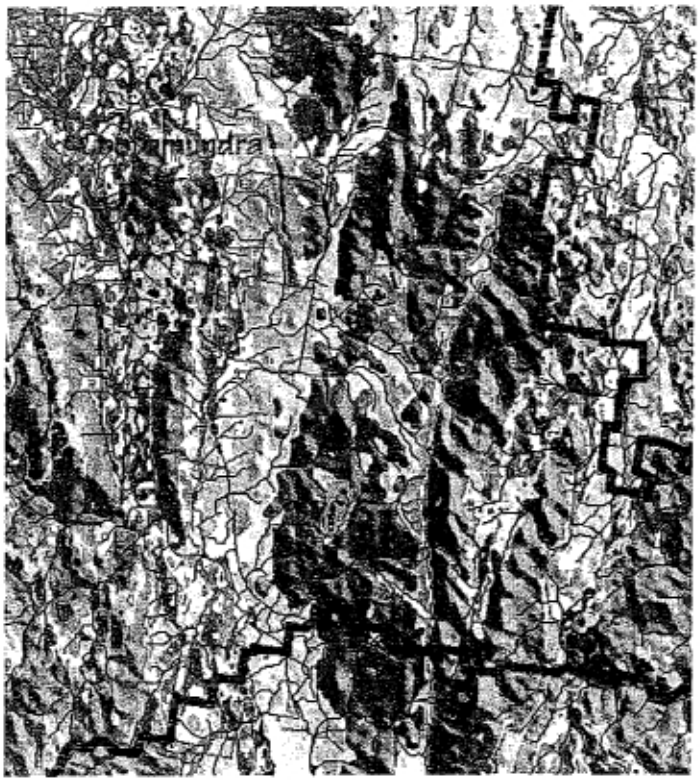
Note: Yellow is the highest EC value for the B2.

Map 4. Highest EC Values (Salinity) for B2.

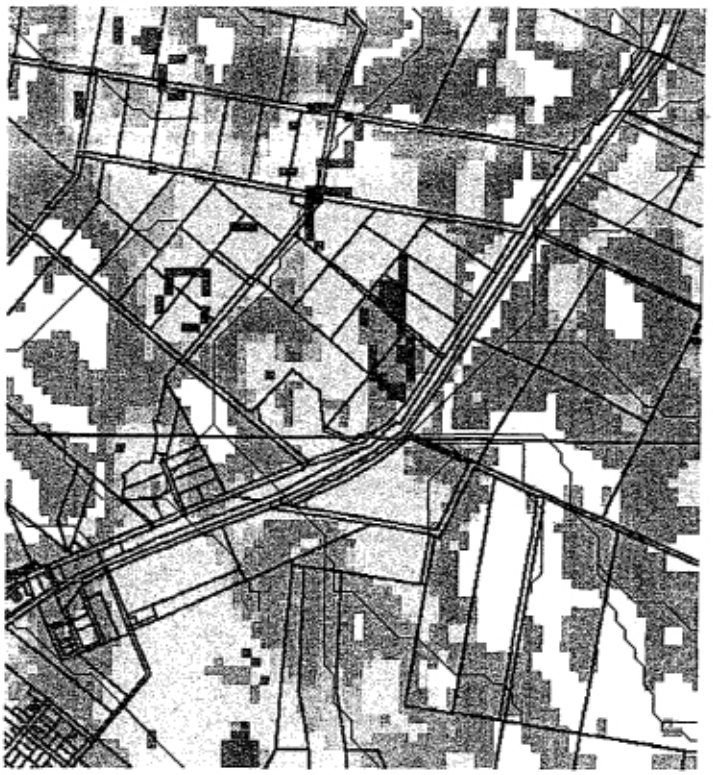


Note: Red is the highest EC value for the B2.

Map 5. Highest EC Values for B2.



Map 6. Highest EC Value for B2.



Key Outcomes of the R&D

It is important to note here that ERIC funded all of the R&D, innovation (ie. transformation of the R&D ideas into commercial products and services), and applied the outcomes in many areas of Australia over a 10 year period from 1992; with outstanding results for clients. No R&D monies were received from government agencies. Also, ERIC contrasted and compared many other techniques including optical satellite data, satellite radar, and airborne and ground-based EM for salinity mapping. After 10 years of R&D and innovation the ERIC position on salinity is yet to be challenged publicly by scientists or the farming community.

The key outcomes of the ERIC R&D using gamma-ray data were:

- Gamma-ray data provided the most cost effective approach to mapping regional areas (ie. areas greater than 200km x 200km, see Map 7) and producing paddock scale information (See Map 8)
- Salt is distributed naturally across the whole landscape in various patterns and pathways, and in various concentrations through the soil profile (See Map 3).
- Salt moves laterally across the landscape, within the soil profile and concentrates in natural pathways that are either associated primarily with geological lineaments or prior stream systems (See Map 4).
- Increased concentrations of salt in the landscape (commonly described as salinity) are primarily associated with natural pathways or accession areas (eg. flat areas of low lateral energy, break of slope positions on hills, etc, see Map 9).
- The increased concentrations (as inputs along pathways or at accession areas) are largely an outcome of land use changes or unsustainable land use practices that degrade soil structure, decrease deep percolation, and increase lateral flows in soil profiles. The increased inputs are often unmatched with increases in the natural drainage (outputs) and results in saturation of the soil profile (often interpreted as rising groundwater) and increased concentrations of salt in these accession areas or nodes in pathways. Salt concentrates at the soil surface due to evaporation and transpiration processes.
- Salt pathways are not correlated with catchments drainage lines (see Map 9) or groundwater mounds.
- Salt pathways are highly correlated with geological features.
- Salinity in Australia is highly associated with past climatic events (eg. wind blown sands, see Map 10) and current climatic conditions (eg. rainfall and evaporation rates).
- There is little or no correlation of the ERIC mapped salinity pathways with salinity risk maps in the National Land and Water Resources Audit Report on Salinity (see Map 11).

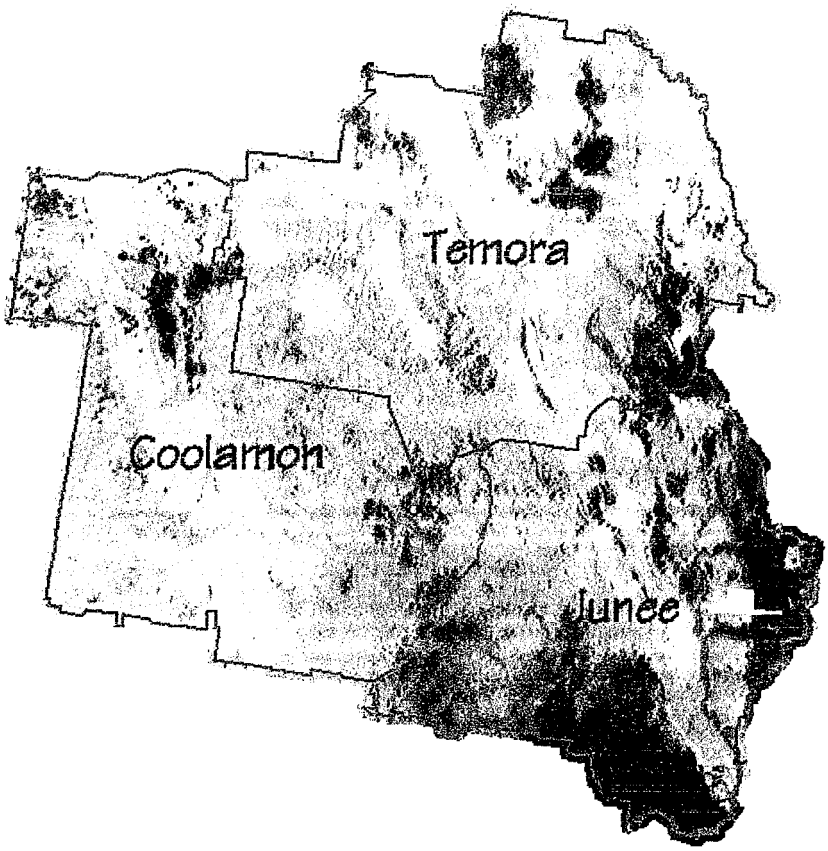
Advantages of Using Gamma-ray Data for Salinity Mapping.

The key advantages of ERIC's approach to salinity mapping are:

- The coverage of gamma-ray data across Australia is reasonably extensive, but varies between the States. For example, Victoria has about 90% coverage and NSW has 60% coverage. Therefore, significant public investment already exists in the data required for map production, while other mapping methods require new data sets that can be expensive to acquire, eg. airborne and ground-based EM methods.
- Gamma-ray represent an objective, physical measure that reflects soil property differences (eg. EC).
- The mapped information developed by ERIC is derived independently of other information used in biophysical analysis.
- The method can provide high discrimination of all measured soil properties that adds considerably more value to land use planners and managers than any other salinity mapping method.
- The gamma-ray measurement is obtained with high spatial density to enable both regional and paddock scale analyses.
- The digital data and data independence allows for numerical analysis with other independent data sets. This enhances the capacity of land use planners and managers to better target saline sites or undertake land capability, enterprise site selection, impact assessment and many other economic and environmental studies (see Map 12).
- The method allows for a very cost effective field verification process that is unmatched by other methods. For example an area of 40,000sq km could be mapped and field measured for salinity for a cost of about $3.00 per sq km. The process can involve local people in the field data collection.

Map 7. EC Pathways map for a Region (200km x 200km)

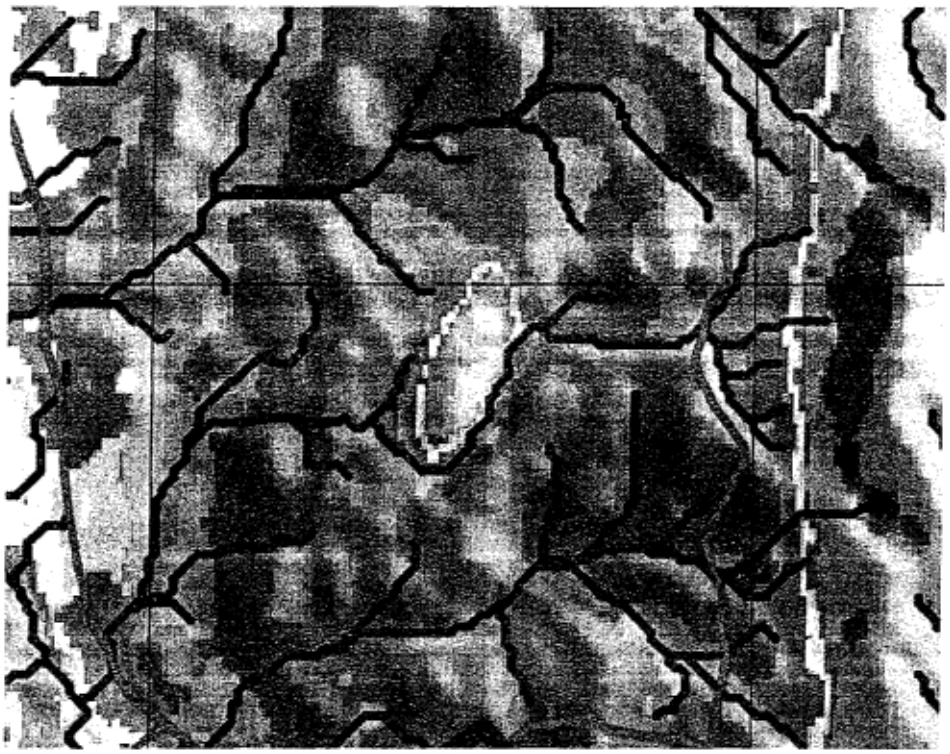
Note: Highest EC values are in yellow, ie a salt pathway.



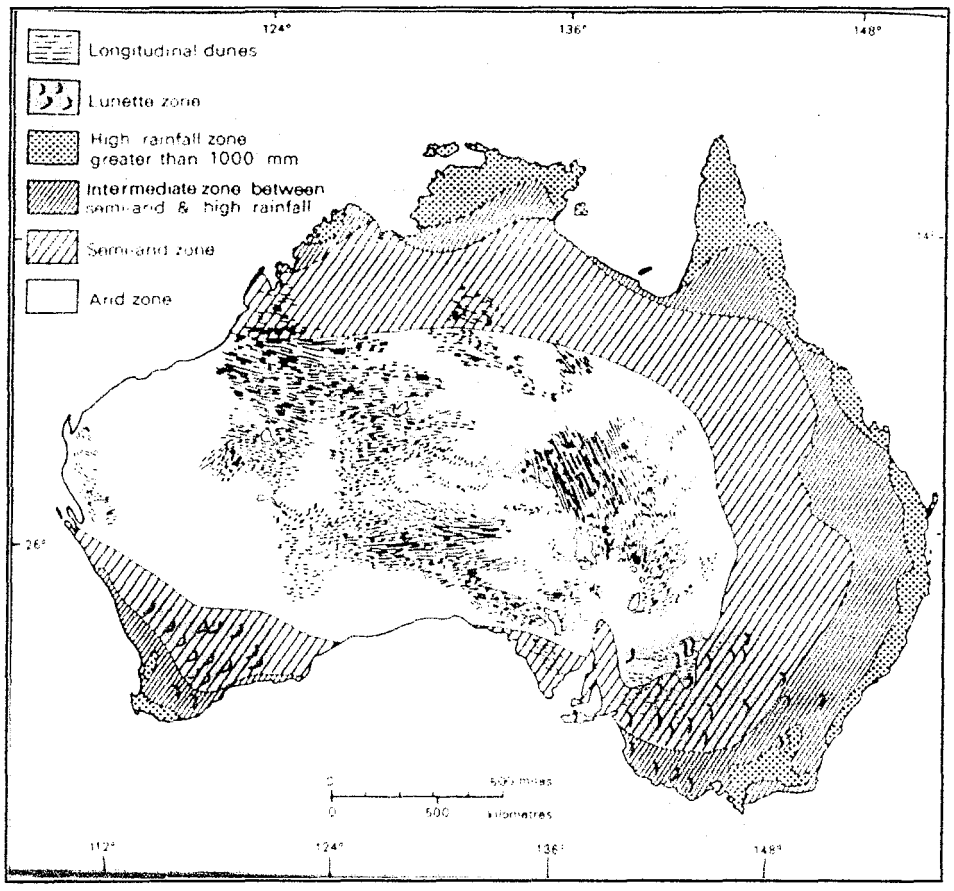
Map 8. Paddock Scale EC Map.

Note: Highest EC values are in yellow, ie a salt pathway.

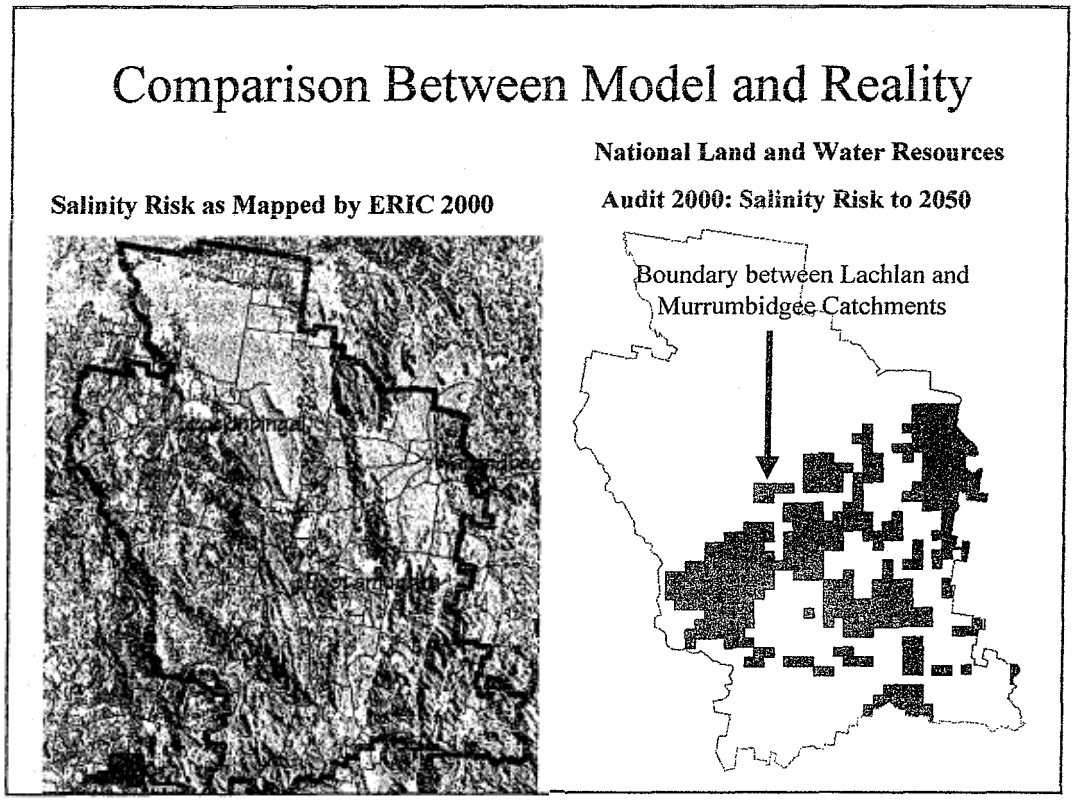
Map 9. Various Expressions of EC Patterns/ Pathways in the Landscape.



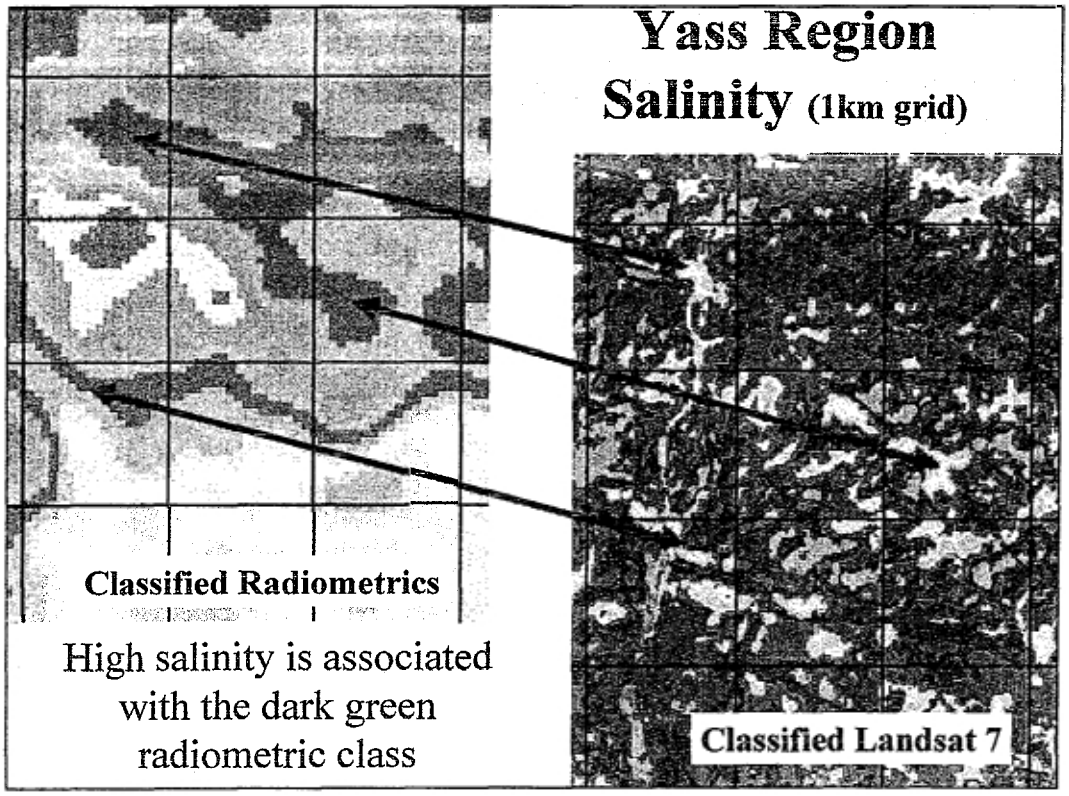
Map 10. Association of Regions of Wind Blown Sands and Salinity in Southern Australia.



Map 11. Comparison of ERIC Mapped Salt Pathways with Salinity Risk Maps in the National Land and Water Resources Audit Report on Salinity-2000.



Map 12. Example of Combining Various Salinity Mapping Methods to Validate Target Sites



Challenges to Existing Salinity Science and Solutions.

While this Inquiry is primarily interested in the use of salinity science and the linkages for coordinating implementation, the description in the Inquiry Information Paper of the science of salinity must be challenged by the Committee as the adequacy of this science is fundamental to successful implementation. The adequacy and understanding of the salinity science determines the options, actions or solutions in implementation. Also, the ERIC salinity mapping method could be implemented at about $1/10^{th}$ of the cost of electromagnetic induction techniques promoted by CSIRO and BRS and ERIC's maps provide the paddock level detail that is necessary for land use management (see Map 8).

The ERIC results clearly challenge the adequacy of groundwater rising model and proficiency of the mapping technologies that has been popularly promoted by government institutions. ERIC found no evidence to support the groundwater rising model as it failed on all mapping applications and the only model that stood any test was a lateral flow model.

It is clear that salt pathways are natural (primary) systems that have existed for aeons, including hyper-saline systems in the lunette systems of SA, Vic and NSW. The primary source of the salt is the geology, often concentrated in marine geology (Gunn, 1985 and Peck, 1973). There is a secondary source with wind blown material and rainfall. Much of this salt has become concentrated in geological lineaments and old prior stream systems through the weathering of soils and lateral water flows.

Salinity is clearly an outcome of increased lateral flows within these geological systems due to land use impacts that degrade soil structure, eg. loss of organic matter in the case of dryland salinity. Many irrigation systems are located on old prior stream systems (eg. Jemalong-Wyldes Plains, Murray and Murrumbidgee Irrigation Areas in NSW) and this co-location has increased significantly the amount of water that moves laterally along prior stream systems that often have higher levels of salt stores than the surrounding soils.

In this respect, the landscape and catchment modelling methods (often used in institutions to produce salinity risk maps- see NLWRA Map 11) have very low reliability and have not matched the reliability of objective mapping methods using geophysical, optical and radar satellite data.

The salinity science descriptions as proscribed in the Inquiry Information Paper need testing as they reflect traditional groundwater rising and salt source models that have been demonstrated by ERIC to be unscientific and unreliable for implementation of management solutions. Salinity represents adverse salt concentrations in water or soil. The definition of adverse depends on perceptions but generally relates to environmental changes considered undesirable by humans, ie. salinity is a social and economic consequence of land use practices that impact on the wellbeing of humans.

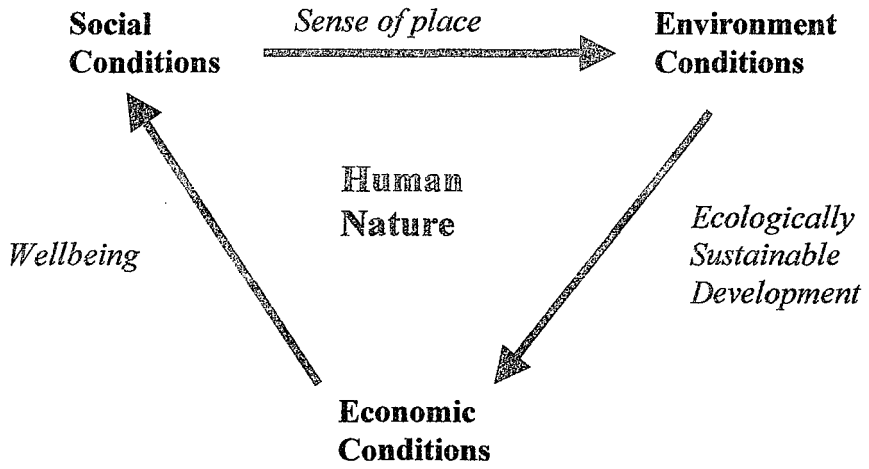
Adverse salinity arises naturally but can be promoted by land use practices. Dryland salinity is the occurrence of adverse salinity associated with dryland agriculture. Irrigated and urban salinity result from adverse salt concentrations associated with those land uses. Adverse salinity generally arises through the dissolution of salt in water, its transport and accumulation elsewhere in the landscape through restricted drainage, and the concentration of the salt through the evaporation of water. Therefore, it can be concluded that dryland, irrigated and urban salinity will arise through changes in hydrology caused by unsustainable land use practices.

The traditional solutions of treating salinity with groundwater management and engineering actions are fundamentally flawed, based on the ERIC results. The solutions to managing the increased concentrations of salt in the land systems should be:

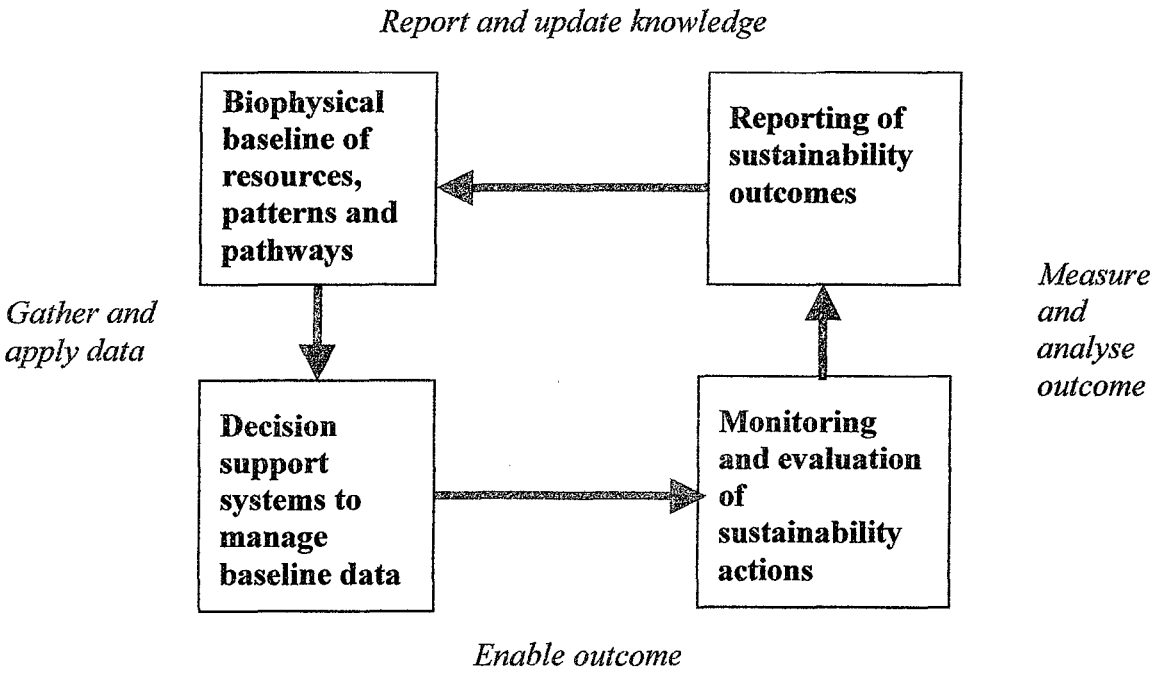
- Better understanding of the location, function and status of salt pathways.
- Better enterprise site risk assessment and site selection.
- Restoration of soil structure decline through the retention and recycling of organic matter in agricultural lands.
- Increased drainage at major saline sites that threaten infrastructure or resource production.
- Decreased water use for enterprises in salt risk areas.
- Increased monitoring of changes in land use conditions using optical satellite data.

A Framework for Sustainability and context for Salinity Management

It is generally accepted that sustainability is founded on the following linkages, conditions and outcomes:



The process of sustainability is generally accepted as following the following sequence, including the fundamental process of environmental management (feedback loops and processes of continuous improvement), compliance and accountability:



This framework and sequence of sustainability actions would apply at all levels of implementation of sustainability (eg. global agreements, national policy, state regulation, regional plans and local actions by industry, local governments and community groups). This framework should guide national programs of sustainability, including natural resource management.

Salt as a Hazard or Risk in a Sustainability Framework

Generally, it can be accepted that salt in the landscape is natural but can have constraints on land uses, as can other soil attributes of pH, soil depth, soil texture, etc. Salt can be managed in a sustainable manner and overall does not represent a major limitation to production or productivity as does climate, weather, plant disease, soil acidity, loss of organic matter, market forces, etc.

There is little economic evidence to support economic decline in rural Australia due to salinity, and much of the salinity can be avoided through better enterprise site selection and land use practices. The linkages

between salinity, land capability, enterprise site selection, production and productivity are not well developed at regional scales or required within the NAPSWQ projects, or other national programs. That is, there is no sustainability framework developed at regional scales that requires feedback systems or processes of continuous improvement that would place salinity within an economic context and priority for resource management actions. The assumption within NAPSWQ projects is that salinity can be addressed through specific actions within a defined budget period and cost. This approach is clearly inefficient and unsustainable.

Overall, it is important for all regions to have maps of salt pathways as they indicate the level of risk associated with any land use or infrastructure development. For example, there are natural salinity impacts on infrastructure and environmental assets but this is largely due to poor enterprise and infrastructure site selection and a lack of knowledge in engineering professions about salinity pathways (eg. salinity pathways under roads, see Map 6). However, risk to an enterprise is relative to the nature of the enterprise and the chance of exacerbating impacts in neighbouring areas (eg. increased irrigation drainage that mobilises salt to other areas). Therefore, it would be better to develop risk assessment methods based on the status or nature of the salt pathway, soil health capability and the characteristics of the associated enterprises. In many respects, it is better to have a range of soil property maps for an area that allow for an objective risk assessment of land use capability and suitability. In this regard, it is incredulous that the Inquiry Information Paper's *contributors of good science* (ie. dot points on page 5) does not include soil health even though land use planning and management is mentioned in other parts of this Paper.

TERMS OF REFERENCE

1. Adequacy of technical and scientific support in applying salinity management options.

The above section of this submission was intended to demonstrate that the current scientific support arrangements that predominate the publicly funded salinity programs are inadequate for developing sustainable solutions for land users. The current NAPSWQ is orientated to research and community group actions. However, it is the skill and willingness in industry to turn ideas into profitable businesses (ie. innovation) that will deliver the new knowledge and solutions to support management actions. The market is the driver of industry innovation not public science.

A more suitable approach, based on the above evidence would be:

- Adopt an approach that places an emphasis on restoring soil health for land use sustainability. This would involve a more general program of land sustainability with actions to map soil properties (eg. texture, pH, EC, etc) that support better enterprise site selection and management actions, eg. by restoring organic matter to farms through regional and city based waste management schemes. The government needs to consolidate and integrate its sustainability programs at regional levels.
- Allocate appropriate public funds to innovation within private companies that have a demonstrated capability to produce commercial outcomes for sustaining land uses. These outcomes would include baseline data and knowledge capacity building, decision support arrangements, monitoring and reporting activities.
- Appoint consortia of local governments and industry associations (eg. regional partnerships) as the lead agencies for implementation of national sustainability programs that include salinity actions.

2. *Use of salinity science base and research data (including the development of new scientific, technical and engineering knowledge) in the management, coordination and implementation of salinity programs.*

There is undoubtedly a major gap between the science produced by government agencies and the process of implementation. While governments have a role in research, policy development, regulation, and compliance in relation to salinity, it is local government and private companies that have capabilities (jointly) for implementation of the public research through innovation, and implementation of policies, regulations and compliance through local service delivery capacities. Unfortunately, commonwealth and state agencies (including their catchment management boards) have attempted to exercise total control of the research, innovation, planning, data collection, decision support, monitoring and reporting activities.

This approach has severely degraded the development of the implementation capability that is inherent and available within the capabilities of local governments and private companies in rural Australia.

My company's desire to become involved in the commonwealth program of R&D, innovation and implementation was frustrated by the commercial agenda's of commonwealth and state agencies and catchment management boards. State bureaucrats manipulate community interests on catchment management boards against local government and industry involvement. These organisations have a lack of interest in new scientific and technical capabilities in industry and the roles of local governments in land use planning and management.

A more suitable approach would be:

- Allocate to a consortia of local governments, industry associations and private companies at least 80% of public funding for environmental/sustainability actions to the four areas of baseline data and knowledge capacity building, decision support systems, monitoring and reporting. The Pratt Water Project in the MIA (economic zone) is a good model that the government should promote to encourage collaboration between public and private sectors and the critical leadership role that industry can provide to sustainability. It is also important to understand that the Pratt Water Project takes a holistic approach to sustainability that is driven by economic efficiencies rather than catchment boundaries.
- Apply strict accountability requirements on public research agencies to demonstrate to the commonwealth parliament that they have diffused research outcomes to industry for innovation actions, collaborated with industry in R&D or outsourced public scientists to private companies for this purpose.
- Require that either private companies or local government staff manage all sustainability implementation projects. This will ensure that future projects have an innovation focus.
- Require all recipients of salinity or any other environmental/sustainability funds to properly account for the use of recognised sustainability framework or environmental management system- EMS (ie. ISO14004). This would include the accounting of land use production and productivity (economic wellbeing) and social values (ie. acknowledged increase in a *sense of place* or quality of environment values). The persistent claims by public scientists and bureaucrats about increases in salinity, loss of production, productivity, and social and environmental amenity need to be properly tested by regional communities. This requires the salinity programs to adequately fund baseline data collection (including economic and social data), decision support systems, monitoring and reporting actions by local governments or industry bodies.

3. Linkages between those conducting research and those implementing salinity solutions, including the coordination and dissemination of research and data across jurisdictions and agencies, and to all relevant decision makers.

The critical issue in this respect is access by land users to the *stock of common good* data/information /knowledge that the public own, yet many government agencies protect with high costs and ineffective distribution systems.

My experience in business has been that in nearly all cases of supporting sustainability or resource assessment actions in rural areas my company has had to build a new baseline of data. This includes salinity hazard or risk maps because of the unreliability or non- availability of resource intelligence from government agencies. In most cases, the public data are too coarse for use in management actions. Farmers need the level of detail on salinity that is evident in Map 8 (page 5).

Local governments are the most appropriate centres for maintaining the *stock of common good* data as they generally employ the technology and skills to develop, maintain and disseminate the data to constituents or collaborators. Most catchment management boards do not have this capability or link to the broader community or industry, and nor do they have the legislative accountability requirements of local governments (except perhaps in Victoria).

In many respects, the regional programs established with the Commonwealth Department of Transport and Regional Development, ie. Regional Partnerships Program and the Area Consultative Committees

provide the type of regional (local government and industry) model that would provide the necessary economic and social linkages and capability to manage national sustainability funds (ie. NAPSWQ and NHT). Overall, there is a need to for the commonwealth to simplify and consolidate the regional linkages that support the national sustainability agenda. This would also encourage the states to simplify program and funding arrangements for sustainability.

The appropriate approach would be:

- Fund consortia of local governments (eg. the Capital Region comprising eight local governments) to provide the regional baseline data sets, decision support systems, monitoring and reporting requirements. It is more likely that local governments would tender industry to provide the implementation services and undertake any necessary innovation in service delivery. Also, local government offices are best equipped to undertake the dissemination of data to constituents and collaborators.
- Ensure that public office or community bids for funds from the NAPSWQ use information technologies and other commercial capabilities from industry as the first choice. There is a propensity for NAPSWQ funds to be used by joint projects of commonwealth and state agencies (cartels) to engage spatial mapping technologies in BRS, CSIRO or state agencies when the technologies and capabilities exist in private industry. The advantage of using private industry capabilities is that the innovation that arises from industry input will be transformed into the implementation processes at local government and corporation levels. In many respects, industry capability in the application of satellite and airborne remotely sensed data for resource assessment is far superior to that in public organisations. It is unfortunate in many ways, that the *environment business* in Australia is largely government business, funded by taxpayers largely through the NAPSWQ and the NHT Funds. This situation is not helping Australia's National Innovation System.
- Support state agencies in the collection of base resource data (eg. satellite and airborne geophysical coverage of the state) for free distribution to local governments and industry that would add the value to the data or produce the necessary local/regional information or resource intelligence.
- Encourage the government research agencies to undertake regional workshops that showcase both public and private industry R&D and innovation for sustainability solutions. It is critical for the government agencies to present themselves as partners with local government and industry rather than competitors in R&D, innovation and service delivery. The current approach that leads government agencies to deal directly with catchment management boards is at the crux of the issue that there is a lack of a strong implementation base for delivering the public investment into R&D, policy, regulation, compliance and salinity solutions.

CONCLUSION

The Committee will need to adopt recommendations that allow local government and private companies to fully participate in the implementation process. Similarly, the rural industry at large (eg. farmers, local government engineers, etc.) that are most affected by the salinity solutions and innovations that are on offer, need the opportunity to compare and contrast the different methods of salinity assessment and management. This social (and commercial) process is imperative to the future collaboration between innovators in industry and land use clients.

Overall, there is a need for public institutions involved in salinity R&D and policy development to engage with the national innovation system through a social process with industry, particularly the knowledge companies that are pioneering new innovations in resource assessment. This innovation process could occur within the funding programs for the implementation of sustainability, however joint R&D work should be separately funded under national R&D programs (eg. ARC).

This Inquiry process needs to set new guidelines for the development of salinity science and innovations. This is necessary to avoid a continuation of the past processes that enabled government workers single-handedly to take salinity mapping, modelling and on-ground solutions up the proverbial *garden path* without a thought for the role of industry and local government in the implementation process. This has largely occurred because the government's funding models promote a *command and control culture* in commonwealth and state agencies and the catchment management authorities/boards that have no links to

regional or local economic planning and management. Also, the *top down* approach to salinity science excludes feedback loops from industry.

There is an expectation by public scientists involved in salinity R&D that new science in industry must be subject to peer review by public scientists as a prerequisite to application in publicly funded programs. However, it is presumptuous to expect private companies to hand over their intellectual property to public scientists for scrutiny or peer review if the public scientists have not been involved jointly or collaboratively in the R&D and innovation processes of companies. Nor can private companies expect specialist public scientists to fully understand complex statistical procedures, image analysis and field survey techniques that may have been integrated by companies for salinity mapping or management. Overall, it is not essential or proper for innovations in industry to be sanctioned or approved by public scientists as the market will sort out product and service excellence. Besides, public science is not subject to independent review by private industry scientists, and issues are sorted out in the market place. Also, the clients of salinity mapping and other management services are primarily concerned with the results rather than the *black box* of science.

Salinity science and salinity implementation in Australia has been a tragic trail of events that gives little public confidence in public science and its transformation into resource or rural sustainability. Catchment management boards are often engaged in preparing management plans with scant intelligence about their natural resource and economic base, nor the technological or skill capacity to manage decisions, monitor against a baseline and report back to the public. In most cases, they duplicate the efforts of local governments and industry. Most rural communities would agree that the past public investments into salinity programs (that focus on salinity as a single environmental issue through public organisations) have not delivered sustainability results or value for money. Salinity is a natural process that can be managed with economic and social solutions, but the public scientists can only recommend that they undertake more research to understand the process.

It is timely for this Inquiry to bring to account the public research agencies and bureaucracies involved in salinity programs (particularly the NDSP) before further public monies are expended on Australia's most misdirected, over funded and exaggerated public program.

RECOMMENDATION

Many of the issues confronting the National Action Plan for Salinity and Water Quality are common to the other national environmental or natural resource management programs. There is a plethora of programs that are not linked but driven by reductionist thinking that best suits the funding interest's of academia and bureaucracy rather than delivering sustainability solutions to communities. The segmentation of sustainability into single-issue programs distracts the innovation and delivery systems from a holistic decision making framework, particularly at regional and local scales.

The current funding process that places government workers in positions of commanding and controlling sustainability measures undermines the motivation, self learning efforts and innovation of industry. The Pratt Water Project is a good model to evaluate and build new sustainability frameworks, provided that local or regional governments are primarily responsible and accountable for land use planning, decision-making, monitoring and reporting on sustainability. A local/regional government and industry partnership approach is the key to implementation of national sustainability policies and environmental management systems.

It would be better that the commonwealth government establishes a sustainability fund that allocates monies to regional governments (or consortia of local governments) in a manner similar to commonwealth road's funding. This fund should primarily be for implementation of government policies on sustainability and not be used for public research purposes. However, it should include support to industry innovation, as part of improving service delivery in the implementation or management process.

It is recommended that the Inquiry Committee propose policies that:

- ***Integrate national environmental or natural resource management programs into a sustainability program or fund that encourages holistic planning, decision support, monitoring and reporting at regional scales.***
- ***Restore the integrity of regional and local governance in sustainability by directly funding consortia of local governments and industry bodies to lead regional (or economic zone) activities in sustainability planning, decision support, monitoring and reporting.***
- ***Increase the funding opportunities for private companies that provide R&D, innovation and delivery support services in sustainability that support both national and regional initiatives.***
- ***Allocate at least 80% of sustainability funds to the implementation process within regional communities.***
- ***Require all public science initiatives on sustainability to be undertaken collaboratively with industry (including specific knowledge companies) and local governments.***

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